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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/501,616 | 05/25/2005 | John Gordon Rushbrooke | 920602-97103 | 2226 |

23644 7590 08/29/2006

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| MIDKIFF, ANASTASIA | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2882 | |

DATE MAILED: 08/29/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) |
|---|---|---|
| | 10/501,616 | RUSHBROOKE ET AL. |
| | Examiner | Art Unit |
| | Anastasia Midkiff | 2882 |

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *67,68,73,76-83,86,87,92,93,96-98,102,103 and 106-111* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *67,68,73,76-83,86,87,92,93,96-98,102,103 and 106-111* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *12 June 2006*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

## DETAILED ACTION

### *Claim Objections*

Claims objected to because of the following informalities:

The claims are replete with narrative language, including the following phrases:

In Claim 77, "as a result of multiple Coulomb scatter," and, "so that they are unable to reach the thin front crystal."

In Claim 80, "which increases the effective energy of the high energy X-ray component that is registered, and hence the magnitude of the material discrimination effect,"

In Claim 81, "to stop electrons produced by X-rays...reaching the rear crystal of the detector array,"

In Claim 86, "to represent the high energy X-ray component,"

In Claim 87, "to prevent left/right asymmetry,"

In Claim 93, "in order to provide matched performance,"

In Claim 97, "so as to provide signals indicative of noise and crystal persistence,"

In Claim 102, "so as to overcome non-linear effects due to saturation,"

For Examination purposes, these phrases, being narrative in nature, provide for an intended use of apparatus, but, since they do not set forth any structure involved in said apparatus, nor any steps involved in the method for its use, these limitations are not given any patentable weight for the apparatus and/or system as claimed. Claims 78, 79, 82, 92, 96, 98, and 103-108 are objected to based on their dependency on the above listed claims.

Appropriate correction is required.

## *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 67, 73, 76-78, 86, 102, and 111 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent to Neale et al. (USP# 5,524,133).

With respect to Claim 67, Neale et al. teach a material discrimination system (Title) including a high energy x-ray source (Column 10, Line 56), with a first detector component in the form of a thin scintillation crystal (Column 3, Lines 48-50) for registering the amount of X-ray energy deposited on the crystal wherein the amount of energy is essentially independent of the X-ray energy (Column 3, Lines 50-51), with a low Z converter located after this thin crystal (Column 3, Lines 52-54), and wherein the low Z converter is situated between the thin front scintillation crystal and a thicker downstream scintillation crystal sandwich (Column 3, Lines 53-58).

With respect to Claim 73, Neale et al. further teach a high Z, high-density converter behind the low Z converter (Column 3, Lines 44-58).

With respect to Claim 76, Neale et al. further tech the use of tungsten to form a high Z converter for removing lower energy photons (Column 3, Lines 30-35).

With respect to Claim 77, Neale et al. further teach scattered electrons traveling backwards out of the thicker downstream crystal are absorbed in both the low and high Z converters (Column 3, Lines 44-63).

With respect to Claim 78, Neale et al. further teach the high Z, high-density converters are interleaved with scintillating crystals (Column 3, Lines 55-57).

With respect to Claim 86, Neale et al. teach an X-ray inspection/material discrimination system (Title) detector (Column 2, Lines 66-67) comprising a front thin crystal and a rear thick crystal sandwich (Column 3, Lines 44-58) wherein the latter is read out by a plurality of read out devices (Column 3, Lines 64-65) which sample at different depths in the beam direction (Column 3, Lines 39-43), and signals from the sampling devices are added (Column 3, Lines 59-67).

With respect to Claim 102, Neale et al. teach an X-ray material discrimination system for X-ray inspection (Title) using high energy X-rays (Column 4, Lines 38-40), which incorporates a Linac [linear accelerator] (10, and Column 10, Lines 55-56), in which the channels are normalized (Column 6, Lines 48-52), and calibration is performed by increasing the X-ray beam flux by known increments (Column 11, Lines 11-15).

With respect to Claim 111, Neale et al. teach a method of testing for the presence of a material whose effective Z is different depending on whether high or low energy X-rays are employed (Column 9, Lines 54-59), comprising the steps of

inspecting an object under test using high energy X-rays and low energy X-rays and noting the effective Z of the constituents of the object at both energies (Column 2, Lines 10-18), comparing the values of Z obtained from the two tests for the constituents in the object (Column 2, Line19), and using a look-up table of known Z ratios for materials using the two X-ray energies to determine the identity of each constituent (Column 2, Lines 7-10 and 20-22).

Claim 93 is rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent to Bjorkholm (USP# 4,511,799).

With respect to Claim 93, Bjorkholm teaches a material discrimination detector for use in an X-ray discrimination system for x-ray inspection using high energy X-rays (Column 2 Lines 32-40, and Column 3 Lines 52-57), wherein a front scintillation crystal (41) and a separate rear scintillation crystal (51) are cut from the same ingot of material (Column 4 Lines 60-68, and Column 5 Lines 1-36).

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claim 68 is rejected under 35 U.S.C. 103(a) as being unpatentable over Neale et al., as applied to Claims 67 and 71 above, in view of U.S. Patent to Shefer et al. (USP# 4,887,604).

With respect to Claim 68, Neale et al. teach most of the necessary elements of the claimed invention, but they do not teach that the low Z converter is formed of aluminum.

Shefer et al. teach a low z converter filter for X-rays formed of aluminum (40) which is suitable for attenuation of the low energy components of an X-ray beam.

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the aluminum converter filter material of Shefer et al. as the low z converter between the crystals of the detector in the system of Neale et al., providing attenuation of low energy X-rays before they reach the high energy crystal, improving the signal-to-noise ratio of detector output, as taught by Shefer et al. (Column 5, Lines 7-10).

Claims 79, 80, 83, 87, and 92 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neale et al., as applied to Claims 78 and 86 above, in view of U.S. Patent to DiFilippo (USP# 6,078,052).

With respect to Claims 79, 80, 83, and 87, Neale et al. teach most of the elements of the invention, including adding the outputs of multiple photodiodes or fibers, but do not teach a pair of photodiodes or fibers connected to each scintillation crystal on opposite sides.

DiFilippo teaches a scintillation detector (Title) wherein the scintillation crystal (12) is read out at all points from opposite sides (Figure 2) by optical fibers (14, 16) adding each signal from each fiber within said bundle, *i.e.,* adding the signals of all fibers in the bundle of fibers at (14), to prevent loss of detectable photons from the crystal (Column 3, Lines 21-27).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the read out system of DiFilippo in the system of Neale et al., capturing all detectable photons and improving spatial resolution and energy resolution of the detector, as taught by DiFilippo (Column 3, Lines 21-27).

With respect to Claim 92, Neale et al. further teach that crystals are read out by optical plastic light guide fibres leading to a CCD (Column 6, Lines 19-23), with all read-outs added to produce a signal corresponding to the high energy x-ray component (Column 3, Lines 59-67).

Claims 81 and 82 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neale et al., as applied to Claim 78 above, in view of U.S. Patent to Williams et al. (USP# 6,294,791).

With respect to Claims 81 and 82, Neale et al. teach most of the necessary elements of the claimed invention, but they do not teach an absorber located at the rear of a detector assembly, wherein the absorber is formed of aluminum.

Williams et al. teach an X-ray material discrimination system (Abstract) wherein there is an absorber (40) in the form of an aluminum beam stop (Column 3, Lines 56-

62), which provides shielding by reducing the intensity of photons that are back scattered from the walls of the system (Column 3 Lines 67, and Column 4 Lines 1-4).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the aluminum beam stop of Williams et al. in the system of Neale et al. to provide shielding by reducing the intensity of photons that are back scattered from the walls of the system (Column 3 Lines 67, and Column 4 Lines 1-4), as taught by Williams et al.

Claim 96 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bjorkholm, as applied to Claim 93 above, in view of Neale et al.

With respect to Claim 96, Bjorkholm teaches most of the necessary elements of the claimed invention, but does not teach the material is CsI (Cesium Iodide).

Neale et al. teach the use of caesium [sic] iodide as the material used for detector scintillation crystals (Column 8, Lines 7-20), which provides strong energy dependence for X-rays absorbed by the crystals (Column 8, Lines 16-20).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the cesium iodide crystals of Neale et al. in the system of Bjorkholm to improve material discrimination at low X-ray energies by increasing the energy dependence of X-ray absorption in the crystals, as taught by Neale et al. (Column 8, Lines 7-20).

Claims 97-98 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent to Grodzins et al. (USP# 6,151,381) in view of U.S. Patent Application Publication to Rivard (PGPUB# 2003/0204126).

With respect to Claims 97 and 98, Grodzins et al. teach a material discrimination system for X-ray inspection (Figure 1, and Column 2 Lines 37-40) of high energy X-rays which includes a Linac (50) for generating high-energy x-rays (Column 2, Lines 37-40), and a detector with crystals (26, 28), wherein a read-out system is synchronized to the Linac pulse with one read-out cycle for each pulse (Column 5 Lines 37-50, and Column 6 Lines 46-50).

Grodzins et al. do not teach that the read-out system also samples the output from detector crystals between each Linac pulse.

Rivard teaches a radiation read-out system for a pulsed radiation source which samples signals during "dead time" (non-pulse-time) to obtain a background count rate, and subtracts this count rate from subsequent detector readings for samples examined (Paragraph 218).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the background calibration of Rivard in the system of Grodzins et al. to remove background noise from the detector and improve accuracy of sample readings, as taught by Rivard (Paragraph 218).

Claims 103 and 106-110 are rejected under 35 U.S.C. 103(a) as being unpatentable over Neale et al., as for Claim 102 above, in view of U.S. Patent to Newman et al. (USP#5,420,441).

With respect to Claims 103 and 107, Neale et al. teach most of the necessary elements of the claimed invention, but do not teach a step wedge of absorbing material with increments of thickness chosen to yield fixed decrements of transmission between 90% and 10%.

Newman et al. teach a lead foil step wedge of varied thickness, which decreases X-ray transmission to a storage phosphor detector by fixed incremental percentages (Column 8, Lines 33-40) which normalizes detector photodiodes by calibration of signal-to-noise ratio of a photodiode detector exposed using calibration wedge signal value vs. average thickness (Column 8, Lines 47-67) and calibration of spatial resolution of photodiode detector exposed using calibration wedge (Column 9, Lines 7-20).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the step wedge calibration of Newman et al. in the detector system and method of Neale et al. to calibrate the detectors accurately for noise and spatial resolution, providing more accurate measurements, as taught by Newman et al. (Column1 Lines 6-10, and Column 2 Lines 10-27).

With respect to Claims 106 and 108, it would have been an obvious matter of finding useful material, subject to availability, to choose PTFE as the step wedge material, since applicant has not disclosed that PTFE solves any stated problem or is

for any particular purpose and it appears that the invention would perform equally well with other x-ray attenuating materials.

With respect to Claim 109, Neale et al. teach a method of material discrimination using X-rays (Abstract) which is performed by generating calibration curves of material discrimination effect (MD) verses transmission (T) (Column 9, Lines 39-42, and Figure 1), wherein the MD effect is derived from the lower and high energy signals (Column 10, Lines 16-18).

Neale et al. does not teach calibration is performed using step wedges of suitable absorbing material, and that T is 1 for zero absorption and 0 for completely absorbing objects.

Newman et al. teach a lead foil step wedge of varied thickness, which decreases X-ray transmission to a storage phosphor detector by fixed incremental percentages (Column 8, Lines 33-40) which normalizes detector photodiodes by calibration of signal-to-noise ratio of a photodiode detector exposed using calibration wedge signal value vs. average thickness (Column 8, Lines 47-67) and calibration of spatial resolution of photodiode detector exposed using calibration wedge (Column 9, Lines 7-20).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the step wedge calibration of Newman et al. in the detector system and method of Neale et al. to calibrate the detectors accurately for noise and spatial resolution, providing more accurate measurements, as taught by Newman et al. (Column1 Lines 6-10, and Column 2 Lines 10-27).

Neale et al., as modified by Newman et al., discloses the claimed invention except for noting transmission is 1 for zero absorbance and 0 for completely absorbing objects. It would have been obvious to one having ordinary skill in the art at the time the invention was made to set these limits for transmission based on absorbance since it was known in the art to do so, and most spectrometers are set up in this manner.

With respect to Claim 110, Neale et al. further teaches a range of calibration curves for different materials (Figure 1, and Column 9, Lines 52-62), whereby the effective Z of an unknown material can then be found by comparing its MD effect and T value with the corresponding values of known materials, and then interpolating (Column 10, Lines 38-44).

***Response to Arguments***

Applicant's arguments with respect to claims 67, 68, 73, 76-83, 86, 87, 92, 93, 96-98, 102, 103, 106-111 have been considered but are moot in view of the new ground(s) of rejection.

With respect to Claims 67-68, Applicant asserts that Neale et al. does not teach a thicker downstream crystal. Examiner respectfully disagrees.

As cited in the prior action, the thicker crystal of Neale is a single sandwich of scintillation crystals forming the functional equivalent of a single crystal that is thicker than the upstream crystal.

With respect to Claim 93, Applicant asserts that Bjorkholm does not teach two separate crystals cut from the same ingot of material. Examiner respectfully disagrees.

Although Bjorkholm describes a single scintillating crystal used for the two crystals of the detectors, which provides the same material for each, the reference also teaches the two sections of crystals act independently, with separate item numbers and separate read-out circuitry, wherein each crystal within the single crystal acts separately.

With respect to Claim 102, Applicant asserts that the Linac channel normalization of Neale is not normalized "so as to overcome non-linear effects due to saturation." Examiner respectfully disagrees.

Examiner has noted that this passage in the claim is narrative in the above and prior objections. However, it is noted that the normalization of Neale would also provide the benefits described by the claim.

Further with respect to Claim 102, Applicant asserts that Neale does not perform a calibration prior to a measurement. Examiner respectfully disagrees.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., a calibration performed prior to measurement) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Examiner notes, however, that Neale does teach the calibration performed before measurement by the x-ray device (Column 11 Lines 11-15, and Column 12 Lines 24-26).

With respect to Claim 111, Applicant asserts that Neale does not teach finding and using the effective Z of constituents to determine constituent identity. Examiner respectfully disagrees.

As cited in the above and prior action, and as admitted by Applicant (see Remarks, Page 13, Paragraphs1-2), Neale uses the effective atomic number of the constituents. Examiner respectfully submits that this is the same value, as the effective atomic number is commonly referred to as the effective Z of an element.

With respect to Claim 83, Applicant asserts that Neale, in view of DeFilippo, does not teach that signals are added from two opposite sides of the crystal. Examiner respectfully disagrees.

DeFilippo teaches two sets of optical fibers (14, 16) in which each set of fibers has fibers at opposite ends of their face of the crystal, *i.e.,* the two fibers at the opposite ends of the bundle of fibers at (14) and/or the two fibers at opposite ends of the bundle at (16). For each bundle (14, 16) these end fibers' outputs are added together, for the purpose of improving the spatial and energy resolution of the detector (DeFilippo, Column 3, Lines 21-27).

With respect to Claim 97, Applicant asserts that Grodzins, in view of Rivard, does not teach a background count rate being measured. Examiner respectfully disagrees.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., measuring a background count rate) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the

specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). In this case, the claims require the read-out system to sample the output from crystals of the detector between each Linac pulse, which Rivard teaches (Paragraph 218).

Further with respect to Claim 97, Applicant asserts that Rivard is not concerned with material discrimination. Examiner respectfully disagrees.

Rivard was not relied upon for a material discrimination system, as Grodzins is the primary reference which teaches using x-rays for material discrimination, as cited in the above and previous actions. Rivard is concerned with calibration of a radiation detector to improve the detection of emission events, by using the measured dead time, background count rate, and calculating the true count rate that was not due to crystal persistence and noise in the detector (Paragraph 218).

With respect to Claim 109, Applicant asserts that Neale, in view of Newman, does not teach a material discrimination effect used for generating calibration curves. Examiner respectfully disagrees.

Neale teaches the use of higher and lower energy signals to create the calibration curves shown in Figures 1 and 2, as cited in the above and previous action (Column 9 Lines 39-42, and Column 10, Lines 16-18), wherein the material discrimination effect is defined in the Claim as "the MD effect is derived from the lower and higher energy signals." Newman, as cited above and previously, provides the step wedge used for a calibration of this type to calibrate the detectors accurately for noise

and spatial resolution, providing more accurate measurements, as taught by Newman et al. (Column1 Lines 6-10, and Column 2 Lines 10-27).

***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anastasia Midkiff whose telephone number is 571-272-5053. The examiner can normally be reached on M-F 7-4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Glick can be reached on 571-272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

ASM
8/24/06

Courtney Thomas
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